

# **LevelBAR™**

## **Electronic Column Display System**



### **Installation and Operations Manual**

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The information contained in this manual was accurate at the time of release. Specifications are subject to change without notice.

**Warranty** - All King Engineering products are guaranteed to be free from defects in material and workmanship for one year from the date of purchase. Any product or part found to be defective under normal use within one year of purchase will be repaired or replaced at no charge if returned to the company at Ann Arbor, Michigan within ten days of discovery of the defect. No other warranties, whether expressed, implied or statutory, including the warranties of fitness for a particular purpose or merchantability, are given by this agreement.

The exclusive remedy for nonconformity of these goods shall be repair and/or replacement of the nonconforming goods or parts.

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#### Revisions:

- (A) December, 1993 – Original Release.
- (B) April, 1994 – Revised Indicator Scale text, added pages 12 & 13 and revised Signal Jumper drawing.
- (C) Added jumper wire note on page 10.
- (D) 734 Area code update/front cover pic

**Table of Contents –**

Specifications .....	page 4
User Details .....	page 5
Electronic Input (4-20 mA) Overview .....	page 6
Pneumatic Input (w/ Internal D/P Transmitter) Overview .....	page 6
Indicator Scale .....	page 7
Scale Installation/Removal .....	page 7
Scale Adjustment Settings .....	page 10
REF LOW, REF HIGH Adjustments .....	page 10
Signal Jumper (24 Vdc Power) .....	page 11
Power (AC) .....	page 11
4-20 mA Signal Connections .....	page 11
Pneumatic (Pressure) Input Connections .....	page 12
Troubleshooting Checklist .....	page 16

**Model Numbers –**

- **5110-10** – Electronic Input (4-20 mA)
- **5110-20** – Pneumatic Input (0-5 psid)
- **5110-21** – Pneumatic Input (0-10 psid)
- **5110-22** – Pneumatic Input (0-15 psid)
- **5110-23** – Pneumatic Input (0-30 psid)
- **5110-24** – Pneumatic Input (0-50 psid)

## Specifications

**Display Accuracy/Resolution**

1%

**Number of Segments**

100

**Display Type**

LED

**Display Length**

10" / 254 mm

**Input Power**

115 Vac 50/60 Hz nominal

**Output Power**

24 Vdc (transmitter excitation)

**Input Impedance (Resistance)**

130 ohm nominal (3.0 Vdc drop @ 20 mA)

**Current Limiting (Overload)**

70 mA dc maximum current; automatic trip/reset circuit using PTC (positive temperature coefficient) resistor limits current overload if signal loop is shorted out.

**Electronic Input Model Only**

**Input Signal**

4-12 mA dc thru 4-20 mA dc

**D/P Option Models Only**

**Input Pressure Ranges**

0-5, -10, -15, -30, -50 psid fixed range transmitter element (accepts clean, dry air/gas pressure input). Maximum pressure rating is 300% FS.

Minimum pressure range for proper operation is 50% of nominal. The lowest acceptable input pressure range is 0-2.5 psid using the 0-5 psid transducer element.

**Transmitter Accuracy**

0.5% FS

**Output**

4-20 mA dc (assumes FSO)

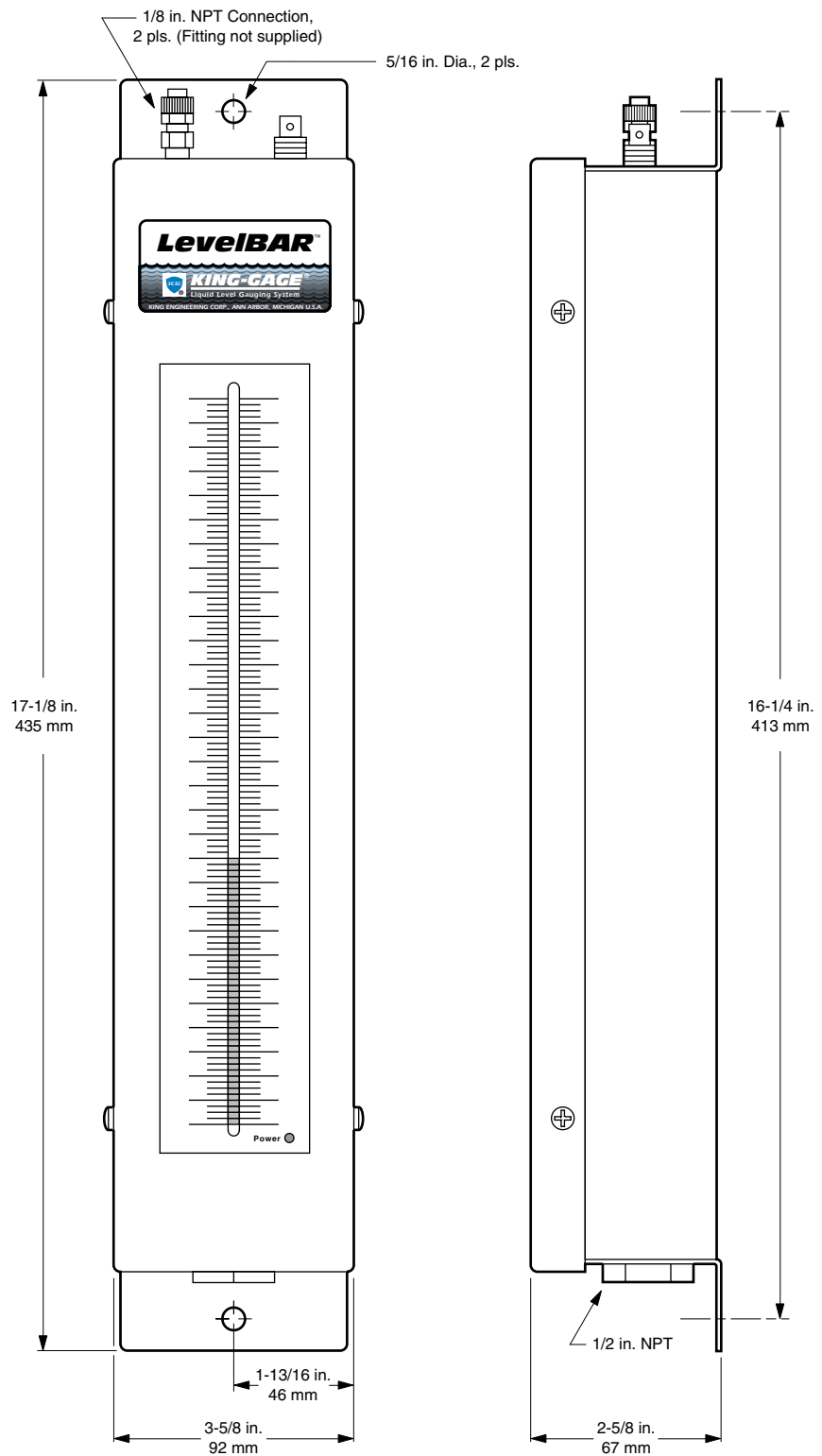
**Power Supply Voltage (External)**

10-42 Vdc (unregulated)

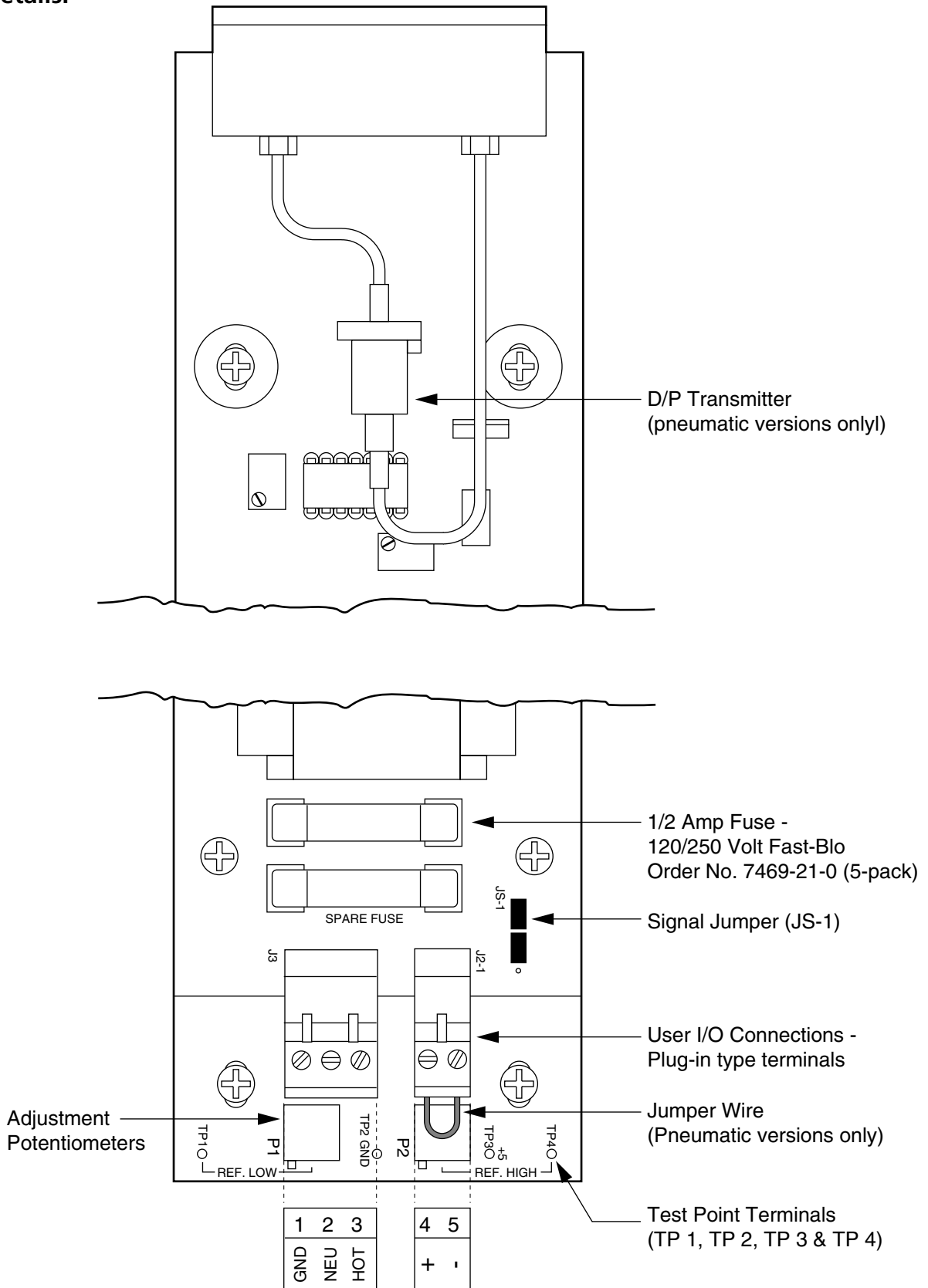
**Maximum Load Capacity**

1400 ohms @ 42 Vdc (external power)

500 ohms @ 24 Vdc (internal power)



User Details:



### Electronic Input (4-20 mA)

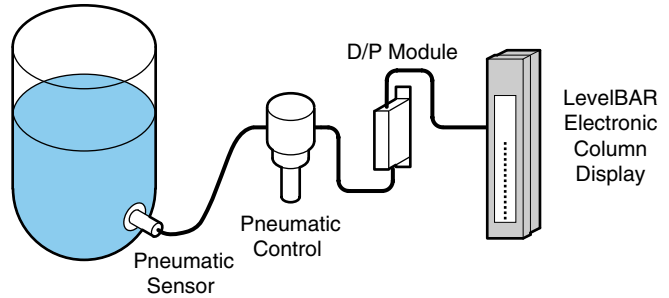
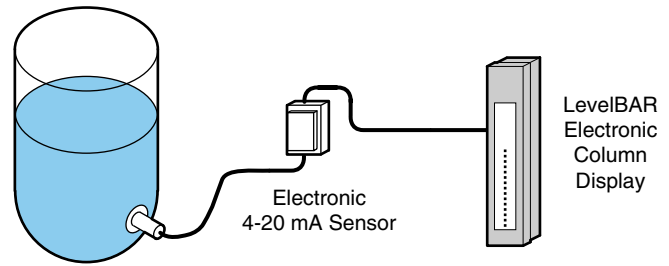
The electronic input version will accept a standard 4-20 mAdc signal from any typical two wire pressure transmitter. A full scale ranging feature allows the LevelBAR to be used with fixed range pressure devices in situations where maximum signal output would be less than 20 mA.

**Model No. Description**

5110-10 electronic input 4-20 mA indicator

**Principle of Operation –**

The electronic input version (p.n. 5110-10) will accept a 4-20 mA signal from any two-wire pressure transmitter. Individual LED segments on the display column illuminate as the signal (e.g., tank depth) increases. The scale itself is custom marked for the actual tank dimensions and milliamp output of the external transmitter. (This milliamp range is a factor of the transmitter span and actual pressure created by the tank gauging application.)



Pressure signal from Bubbler or Air-Driven Sensor is transmitted to LevelBAR (D/P Option)

### Pneumatic Input (w/ Internal D/P Transmitter)

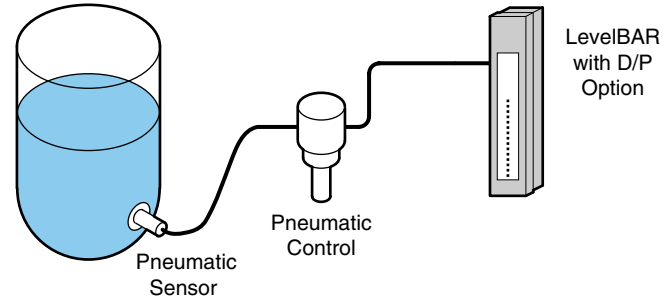
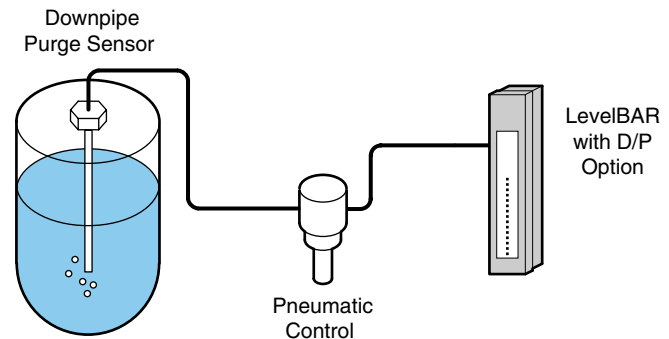
A differential pressure (D/P) option incorporates an internal fixed range electronic transmitter as part of the indicator package. This provides a 4-20 mAdc signal proportional to the pneumatic input applied. A scale ranging adjustment obtains full scale display where maximum pressure input is less than the transmitter upper pressure range.

**Model No. Description**

- 5110-20 fixed range transmitter 0-5 psid.
- 5110-21 fixed range transmitter 0-10 psid.
- 5110-22 fixed range transmitter 0-15 psid.
- 5110-23 fixed range transmitter 0-30 psid.
- 5110-24 fixed range transmitter 0-50 psid.

**Principle of Operation –**

When used with either an air-driven diaphragm sensor or bubbler, the pressure signal is directed into the LevelBAR (with D/P option). The internal electronic transmitter generates a milliamp output in response to the applied pressure. Individual LED segments on the display column illuminate as the signal (e.g., tank depth) increases. The scale itself is custom marked for the actual tank dimensions and pressure range of the gauging application.



4-20 mA signal from Sensor or Electronic Transmitter is transmitted to LevelBAR

## Indicator Scale

Scales are marked for readout in a specified unit of measurement such as weight (pounds, kilograms, tons) or volume (gallons, liters, barrels, etc.). Each scale is uniquely graduated based on pressure range, tank geometry and density (specific gravity) of the contents.

**Scale Serial Number** - A unique LVB-#### serial number appears at the lower left hand of each scale.

**Scaling Adjustment Setting** - Refer to "REF HIGH =" notation on right hand edge of scale. This notes the scaling adjustment settings and pressure range of the transmitter.

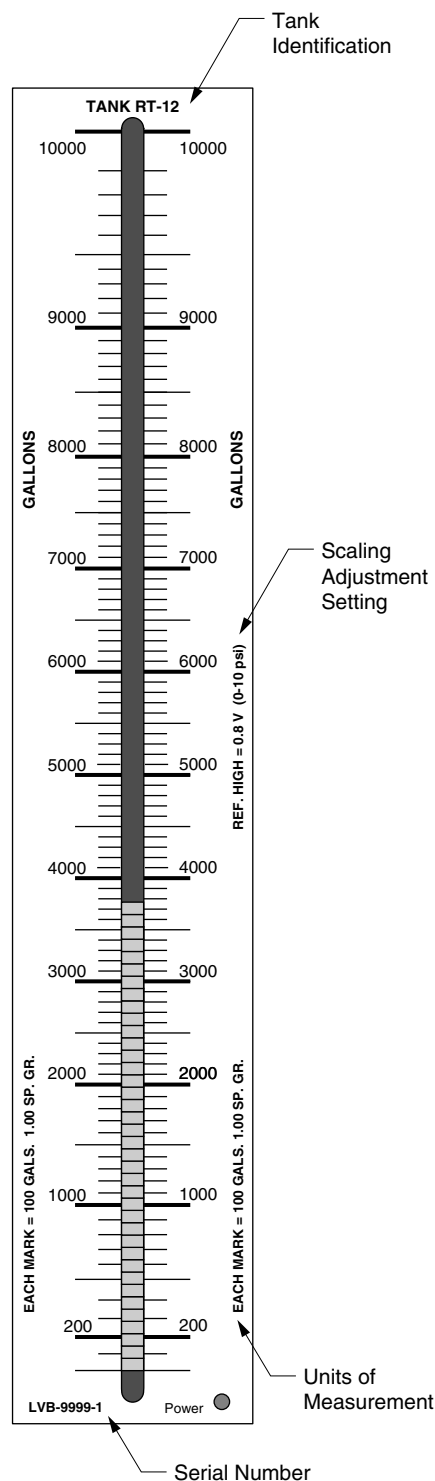
**Tank Identification** - The tank designation appears at the top of the scale.

## Scale Installation/Removal

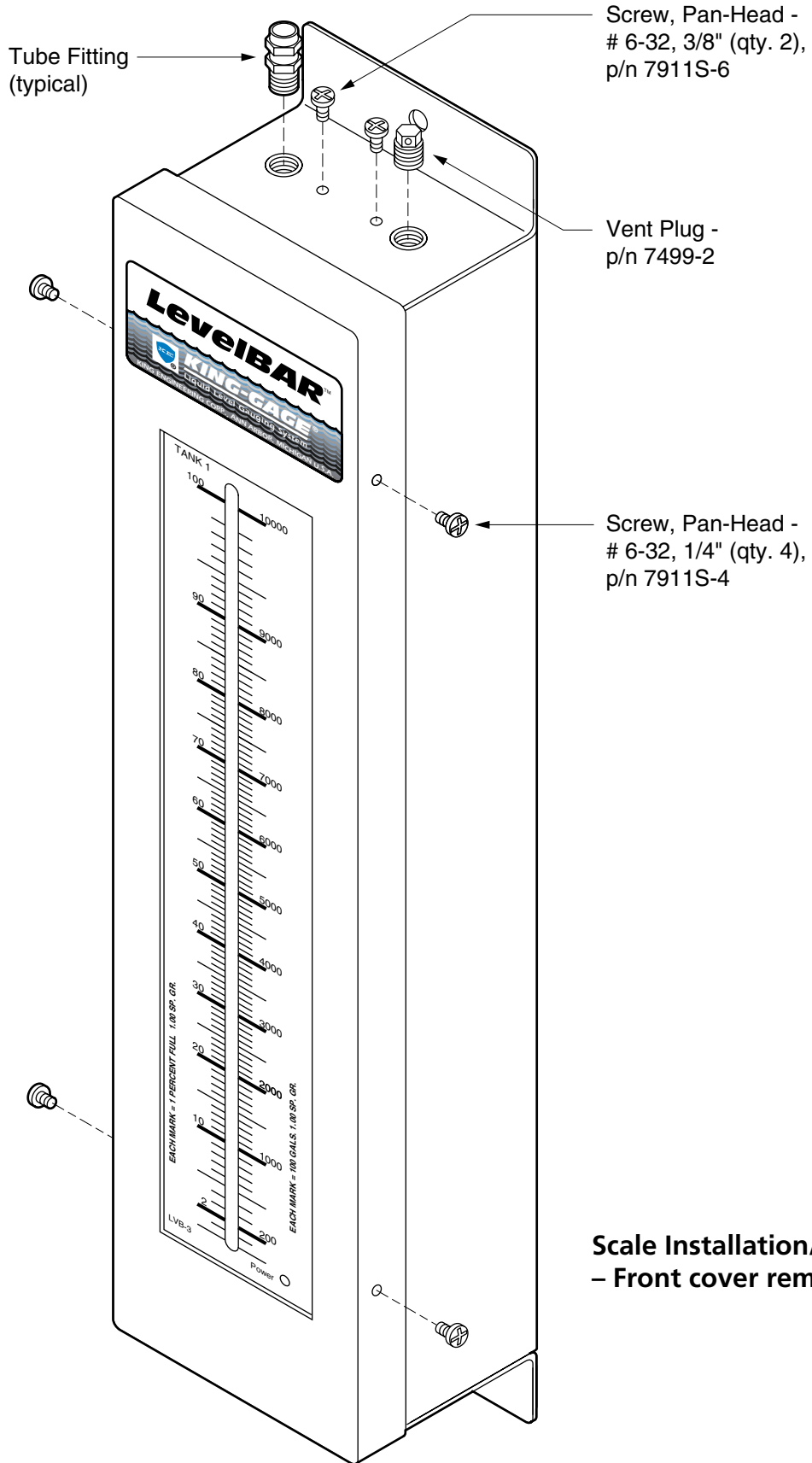
The front cover must be removed to access the indicator scale. Disconnect all tube fittings, lines, etc. from top of LevelBAR housing prior to unfastening cover assembly. Refer to illustrations on pages 8 and 9.

1. Remove two (2) screws at top of housing as shown in illustration.
2. Remove four (4) screws on sides of housing to unfasten cover. Note that LevelBAR chassis is mounted to inside of cover assembly. If possible, place cover on horizontal surface before proceeding further with disassembly.
3. Scale Removal: From backside of cover, remove the four (4) small panhead screws to unfasten the circuit board assembly. Unthread the four (4) stand-offs to access scale.
4. Re-assemble in reverse order, beginning with scale.

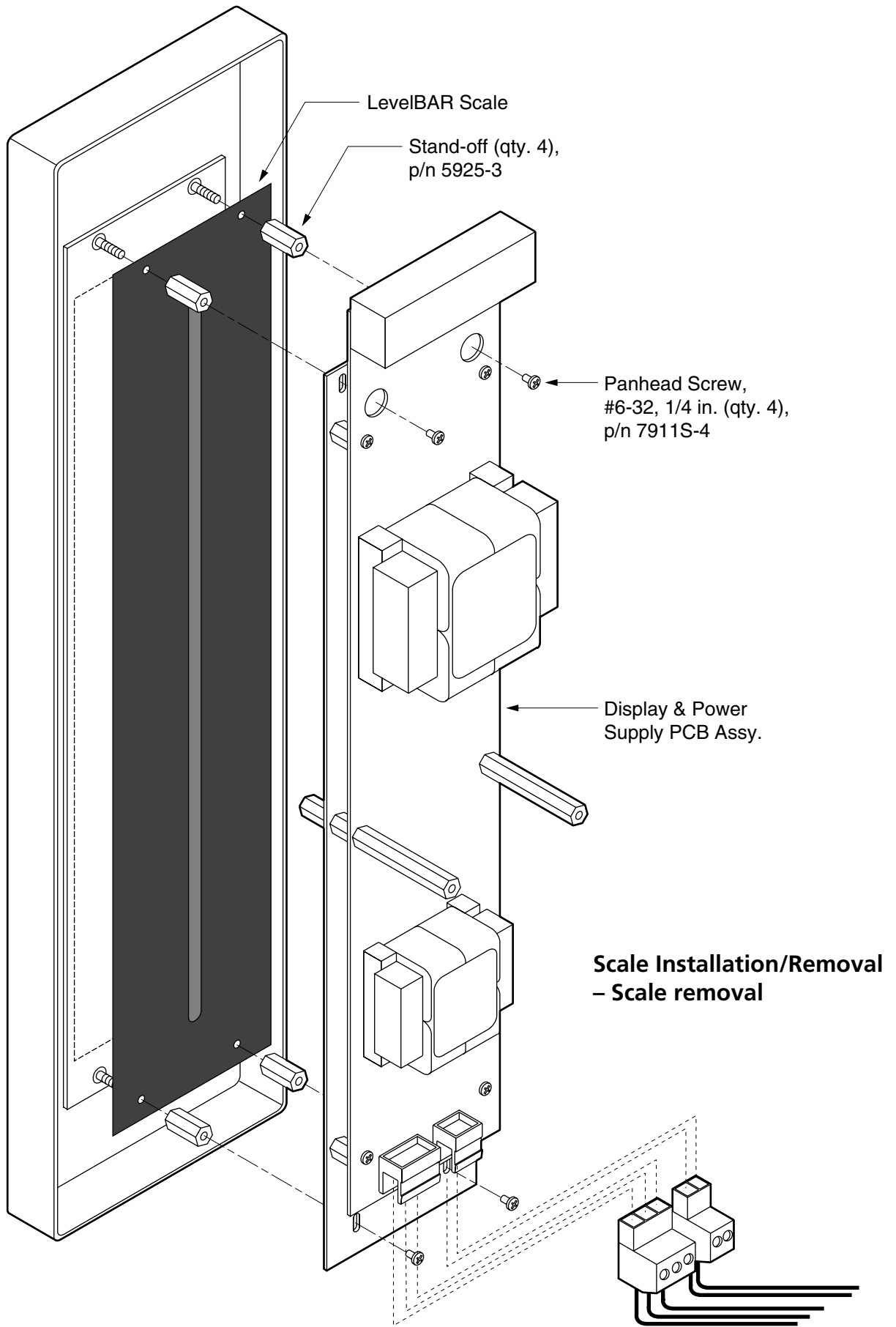
NOTE: Use the Power indicator (red LED) to check scale alignment. Power indicator should appear centered in scale opening. If not adjust circuit board assembly upward or downward by slightly loosening the four (4) screws noted in Step #2 above. Once properly aligned, tighten screws securely. The bottom mark on the scale should be aligned with the bottom edge of the first LED segment.



**LevelBAR Scales are marked for the specific tank geometry. Liquid in the tank can be measured by volume or total weight.**







### Scaling Adjustment Settings

The multi-segment LED column is adjustable for full scale display of any milliamp value between 12-20 mA<sub>dc</sub> generated by the transmitter. A custom marked scale, graduated in any selected engineering unit (lbs, gal., liters, etc.), is mounted alongside of the display column. The LED column segments provide a clear, graphic indication of tank levels for operations personnel.

The scaling adjustments for the indicator are identified as "REF LOW" and "REF HIGH". When the LevelBAR is supplied with the graduated scale already installed, these scaling settings are factory preset. Field installing a graduated scale will require setting the scaling adjustments. The scaling factor is based on the upper milliamp value generated by the transmitter in response to applied pressure.

If the maximum applied pressure is below full scale (FS) using the LevelBAR's fixed pressure range transmitter, the highest milliamp value will be below 20 mA. This also will be true of external fixed range devices, such as the KING-GAGE Electronic Sensor. The scaling adjustment required is based on the actual upper milliamp value and can be determined using the following calculation:

$$\text{max. mA} \times 0.05 = \text{V (REF HIGH voltage)}$$

The minimum input value at which a full height column display can be generated is 12 mA. Maximum input is 20 mA.

$$4-12 \text{ mA} = 0.2 - 0.6 \text{ V (REF voltage span)}$$

$$4-20 \text{ mA} = 0.2 - 1.0 \text{ V (REF voltage span)}$$

### REF LOW, REF HIGH Adjustments

Each scale is marked with the specified REF voltage settings (REF HIGH) required to match the scale calibrations. This ensures that the indicator will correctly display level for the specified tank. The REF LOW setting should always be 0.2 V. REF HIGH settings will vary between 0.6 - 1.0 V depending upon the individual scale calibration.

Note: Use only a voltmeter or multimeter having 1/2% or better accuracy when measuring REF voltage settings.

### Setting Procedure:

1. Connect meter leads to TP4 (high) and TP2 (gnd). Adjust REF HIGH potentiometer to match voltage setting specified on indicator scale.
2. Check REF LOW with meter leads connected to TP1 (low) and TP2 (gnd). Adjust as necessary to 0.2 V.
3. Re-check REF HIGH after any adjustments to the LOW setting since there may be some interaction between the two.

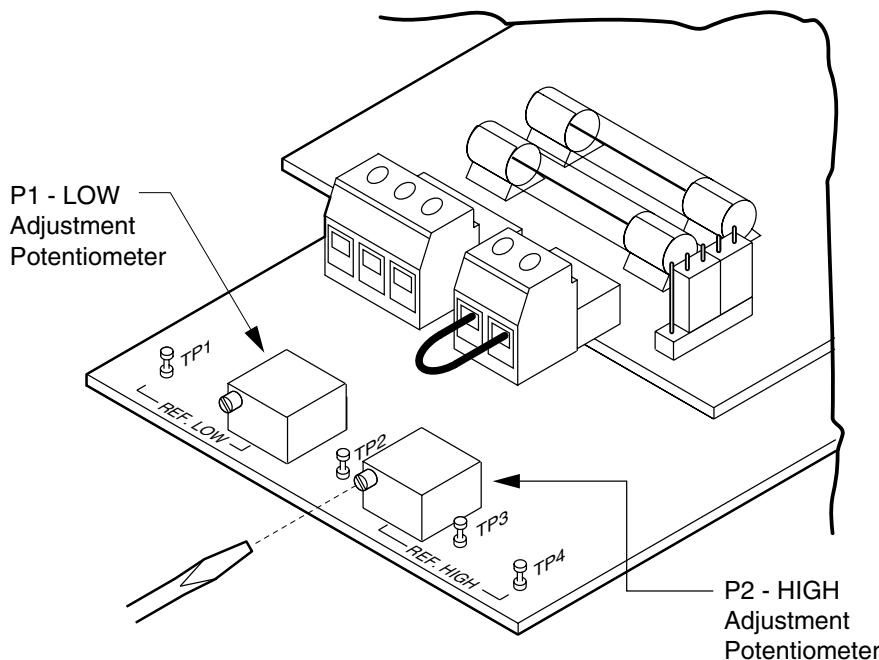
### Test Point Terminals

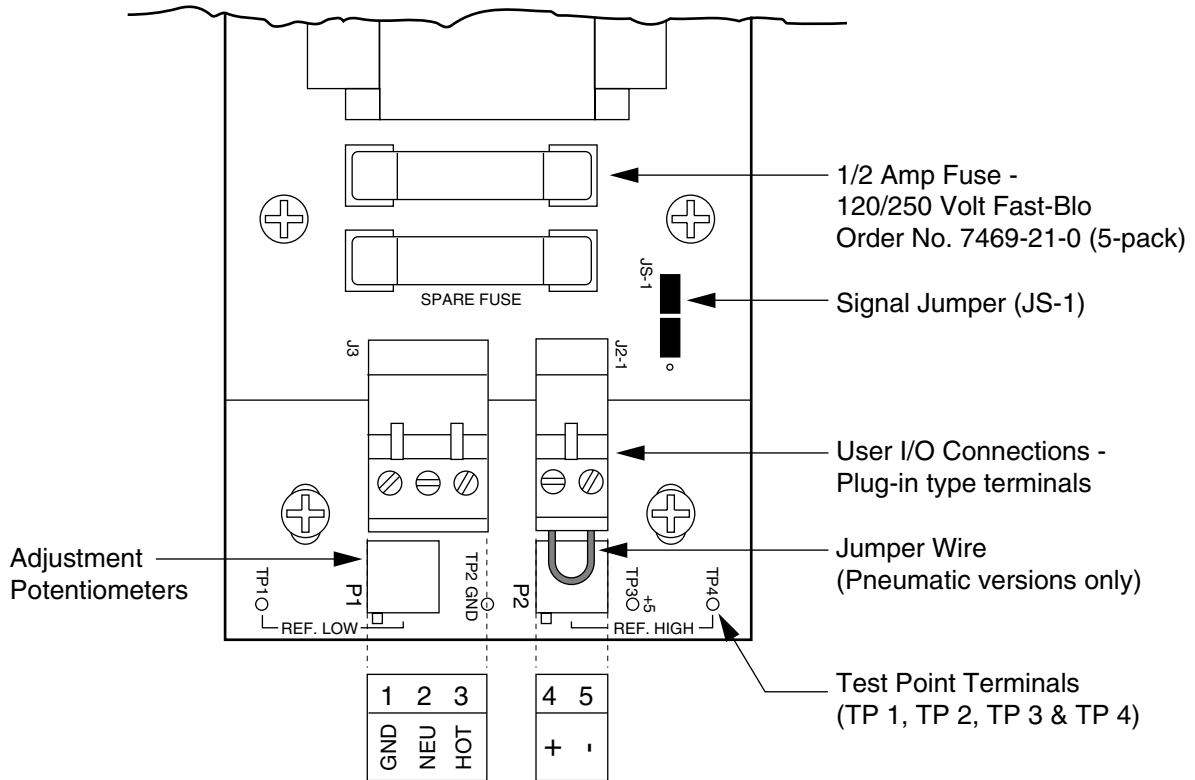
- TP1 - LOW voltage (0.2 V)
- TP2 - GND common ground
- TP3 - +5 V
- TP4 - HIGH voltage (0.6-1.0 V)

### Adjustment Potentiometers

- P1 - LOW adjustment potentiometer
- P2 - HIGH adjustment potentiometer

**Jumper wire must be in place** at signal terminals when reading REF values.





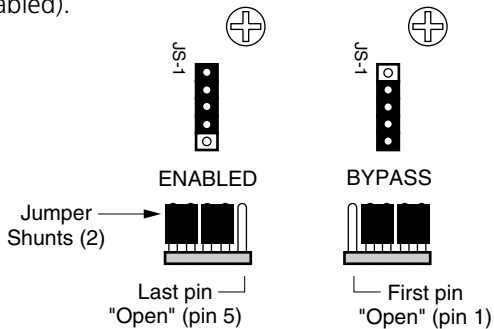
**Signal Jumper (24 Vdc Power)**

The LevelBAR indicator has an on-board 24 Vdc power supply which powers the internal pressure transmitter. When using the internal transmitter (D/P option models only) the signal jumper (JS-1) is positioned to enable the on-board 24 Vdc supply.

For electronic input version (4-20 mA) LevelBAR, this 24 Vdc supply can either be enabled or bypassed, depending upon whether an external transmitter power supply is already being used.

**JS-1 Enable Position:** +24 Vdc is applied through the + signal terminal inside of the LevelBAR enclosure.

**JS-1 Bypass Position:** Power supply is bypassed (disabled).



**Power (AC)**

1	2	3
GND	NEU	HOT

Connect the LevelBAR indicator to a source of 120 Vac, 50/60 Hz. power for operation. Maintain polarity (HOT/NEU/GND) as indicated.

4	5
+	.

**4-20 mA Signal Connections**

**D/P Option Models**

LevelBAR indicators that include the internal D/P transmitter can provide a 4-20 mA output\* signal for monitoring or control use. If the 4-20 mA output will not be used, the factory installed jumper must remain in place at the signal connector.

\* Actual milliamp output range may be less than 20 mA depending upon application and pressure range of D/P transmitter.

**Electronic Input Model**

When used with an external transmitter, the LevelBAR signal connections will accept any standard 4-20 mA input. An available on-board 24 Vdc power supply can be used to power the transmitter signal loop. If an external power supply will be used, the +24 Vdc output of the LevelBAR must be bypassed (see Signal Jumper).

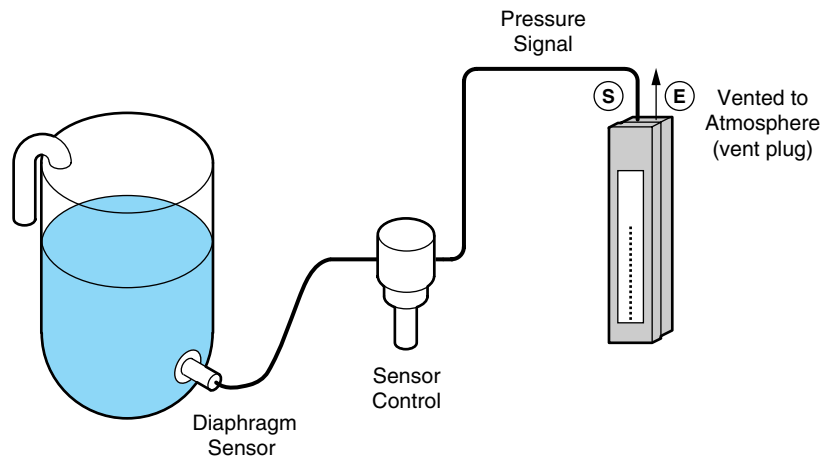
### Pneumatic (Pressure) Input Connections

#### LevelBAR w/ Internal Transducer

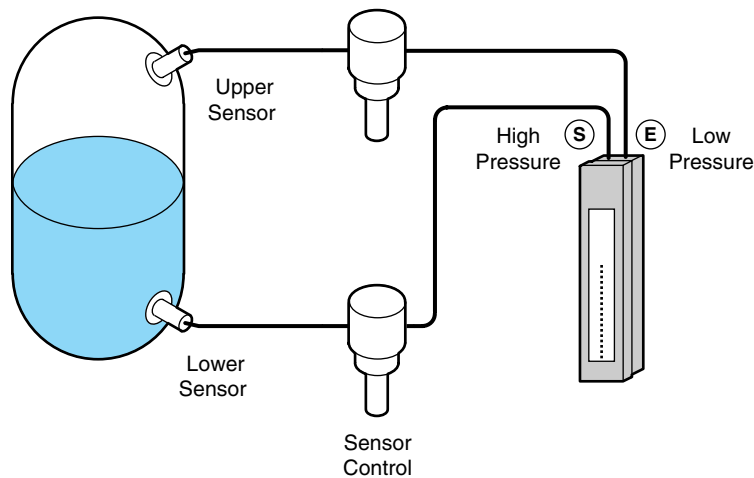
Pneumatic input models include two (2) 1/8" NPT connection ports at the top of the enclosure. These are for **Signal** (high pressure) and **Equalizer** (low pressure) input. Since a majority of applications involve gage pressure relative to atmosphere, a vent plug is provided for the low pressure input.

**E Equalizer** - Low pressure input from upper sensor. This corresponds to sensing the void pressure above the liquid surface in a closed or non-vented tank. In open or vented tanks, this connection is vented to atmosphere. (Steam and/or extremely wet situations may require routing vent line to a dry or protected location.)

**S Signal** - High pressure input from tank sensor. On a closed or non-vented tank gauging application (i.e., differential pressure measurement), this would correspond to the lower tank sensor.



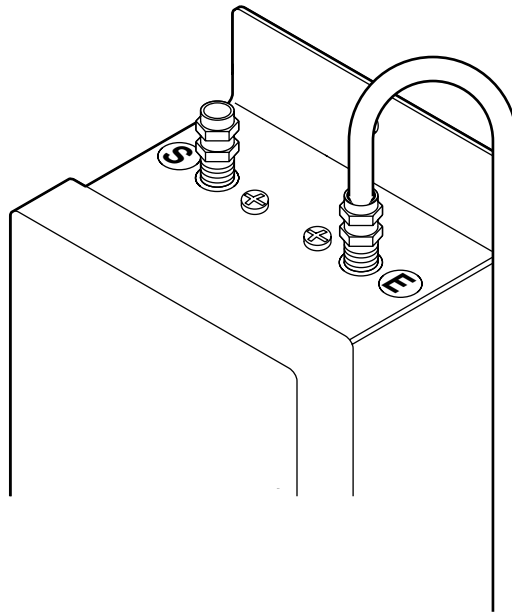
Vented Tank - LevelBAR Connections



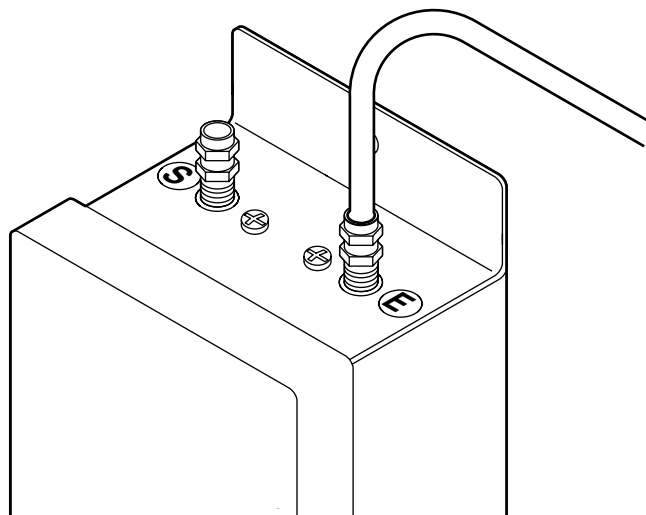
Closed Tank - LevelBAR Connections

**Protected Vent (Wash-Down Locations)**

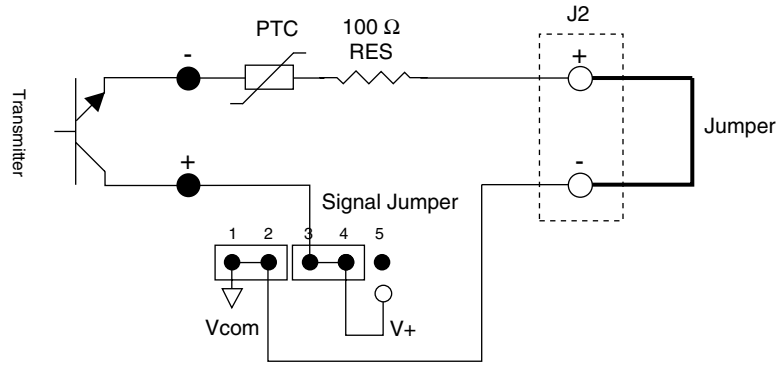
Installing a short tubing run with a downward turn can prevent water or other liquid solutions from being sprayed into the LevelBAR equalizer vent. (When steam is present, route tubing to a dry location.)



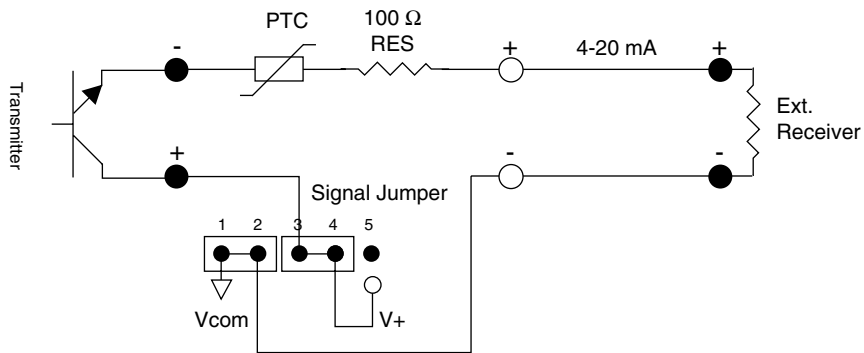
180° Slope - Vent Tube Downward



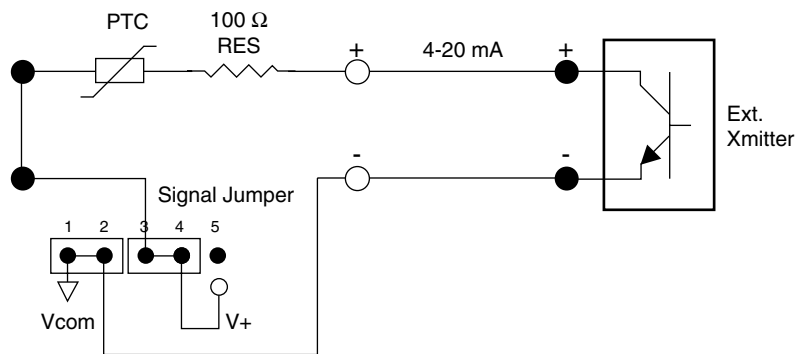
Vent Tube Routed to Alternate Location



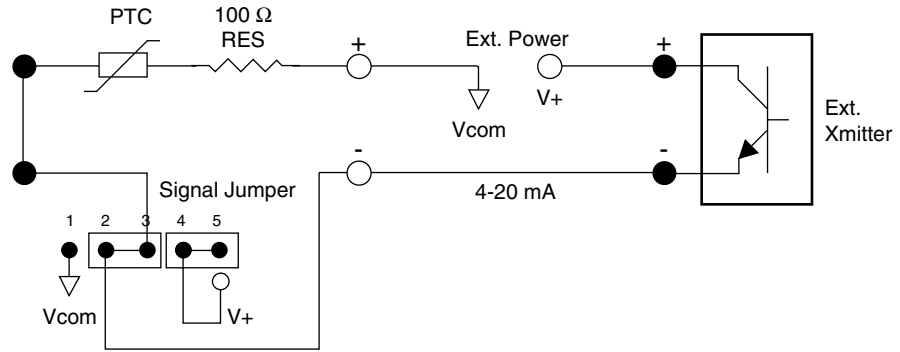
**A - Pneumatic System** – (LevelBAR with +24V enabled, factory jumper for internal signal)



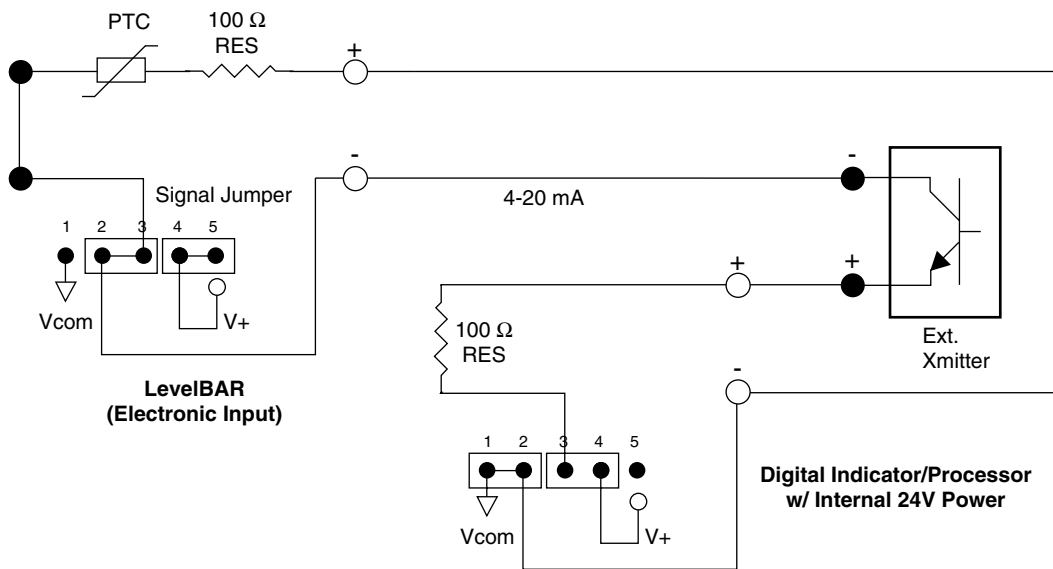
**B - Pneumatic System** – (LevelBAR with +24V enabled, 4-20 mA to external receiver)



**C - Electronic System** – (LevelBAR with +24V enabled, 4-20 mA signal from external transmitter)



**D - Electronic System** – (LevelBAR with external power supply, 4-20 mA signal from external transmitter)



**E - Electronic System** – (LevelBAR as slave display, 4-20 mA from external transmitter)

## Troubleshooting Checklist

### 1. No Display?

#### Try the following . . .

Check to see if Power indicator (red LED) is illuminated. If not, check AC power connection and power source. Also inspect LevelBAR for blown fuse (type 3AG).

**(D/P Option Models)** - Check that jumper wire is installed at signal terminal. If 4-20 mA output is connected to external device, check for continuity of the signal loop. Make certain that +/- sides of the loop are not reversed.

If tank is empty (or input signal is 4.10 mA or less), the LED column will not be illuminated.

### 2. Display Reading Low?

#### Try the following . . .

LevelBAR has a scaling adjustment used to set full scale display. Check adjustment setting against REF HIGH (voltage) value noted on the front scale. Refer to "Scaling Adjustment Setting" beginning on page 10.

If scale adjustment voltage is properly set... Make certain that **Pressure Range** (LevelBAR or external transmitter) is same as noted on front scale.

**(D/P Option Models)** - Check for leaks in pressure tubing, tube fittings and/or internal transmitter pressure connections. Note that LevelBAR cannot display full scale if maximum pressure is less than 50% of the rated pressure range of the unit.

**(Electronic Input Model)** - Check output signal from external pressure transmitter, adjusting span when required (if applicable). Note that LevelBAR cannot display full scale if maximum input is less than 12.00 mAdc.

Scale: Scale is marked based on density of tank contents. If contents has a different specific gravity than liquid for which scale was calibrated, display will not be accurate.

### 3. Display Reading High?

#### Try the following . . .

If tank level is known to be below that shown on LevelBAR, REF HIGH setting may be incorrect. Check adjustment setting against HIGH REF (voltage) value noted on the front scale. Refer to "Scaling Adjustment Setting" beginning on page 10.

If scale adjustment voltage is properly set... Make certain that **Pressure Range** (LevelBAR or external transmitter) is same as noted on front scale.

**(D/P Option Models)** - Pressure input to LevelBAR may be high due to malfunction at pneumatic tank sensor. For bubblers or downpipe system, check for restriction or blockage within downpipe in tank. Also, check for excessively high flow rate or vent restriction at air control unit.

**(Electronic Input Model)** - Check output signal from external pressure transmitter, adjusting span when required (if applicable).

Scale: Scale is marked based on density of tank contents. If contents has a different specific gravity than liquid for which scale was calibrated, display will not be accurate.

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